4.0 SAFETY AND RELIABILITY

SECTION 4.0 SAFETY AND RELIABILITY
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4.0 SAFETY AND RELIABILITY

4.1 FACILITY SAFETY

The Tesla Power Project (TPP) will be designed for safe operation. Potential hazards that could affect project facilities include earthquake, flood, and fire. Safe operation includes safety for the power plant operating personnel, who will be trained to provide proper response to hazards and to avoid unsafe operating conditions.

4.1.1 Natural Hazards

A geotechnical investigation of the proposed power plant site is provided in Appendix G. This investigation includes a review of potential geologic hazards, seismic ground motion, and soil liquefaction. The principal natural hazard associated with the power plant site is potential seismic hazard. The site is located in Seismic Zone 4. All project structures will be designed in conformance with California Building Code (CBC, 1998) criteria for Seismic Zone 4 to ensure safety for operating personnel and adequate protection against structural and equipment damage. The structural and seismic design criteria for project buildings and equipment is provided in Appendix B.

The power plant site varies in elevation from approximately 360 feet above mean sea level (amsl) to 400 feet amsl. The ground floor of plant facilities will be established at approximately 380 feet amsl, and will be well above the 100-year floodplain [Federal Emergency Management Agency (FEMA), 1998].

4.1.2 On-Site Fire Protection Systems

The power plant will be provided with on-site fire protection systems to limit personnel injury, property loss, and plant downtime resulting from a fire. The fire protection systems are described in Section 3.4.10. The facility will have a Fire Protection Plan as outlined in Section 5.14.1.2.

4.1.3 Local Fire Protection Services

In the event of a serious fire, the TPP will receive fire protection services from the Alameda County Fire Department. The nearest fire station is Station No. 8, located at 1617 College Avenue, in Livermore. Station 8 is composed of two (2) engines and three (3) squads with a response area of 280 square miles, the largest response area in the county. Station 8 response times average approximately 30 minutes. The project's Risk Management Plan described in Section 5.12, Hazardous Materials Handling, will provide necessary information on hazardous materials to ensure that safe and effective fire fighting measures are used. Additional information on local emergency services can be found in Section 5.8.

4.1.4 Personnel Safety Programs

The TPP will implement the personnel safety programs described in Section 5.14, Worker Safety, to provide for personnel safety and ensure compliance with federal and state occupational safety and health requirements.

4.2 TRANSMISSION LINE SAFETY AND NUISANCE

4.2.1 Aviation Safety

The TPP will have a transmission interconnection line (approximately 4,000 ft.) connecting the site switchyard to the existing PG&E Tesla Substation, which is located south-southeast of the project site. The transmission interconnection will require new structures between the Tesla Substation and the project switchyard (see Figure 3.6-2, Preliminary Transmission Line Routing Plan). The new transmission line structures will be up to approximately 90 feet in height.

There are two aviation centers in the general vicinity of TPP (Figure 4.2-1), both more than 7 miles from the project site: Tracy Airport and Meadowlark landing strip. The Tracy Airport complex is located approximately 7.1 miles east-southeast of the project site in San Joaquin County. The Tracy Airport has two (2) main runways oriented east-west and northwest-southeast, respectively. These runways are approximately 4,000 ft. in length each. The Meadowlark landing strip is located approximately 7.7 miles southwest of the project site on the east side of Greenville Road, south of Tesla Road (south of the Lawrence Radiation Laboratory complex). The strip consists of a single runway oriented east-west with a length of approximately 1,680 ft.

In accordance with the federal aviation regulations cited in Title 14, Code of Federal Regulations, Part 77, a Notice of Construction should be filed with the Federal Aviation Administration (FAA) if there is any structure rising 200 feet (500 feet in an uncongested area) above the average ground level in the vicinity of the construction site. A notice is also required if any structure protrudes above an imaginary surface (plane) extending from the end of any runway at a slope of 50:1 for 10,000 feet if the runway length is 3,200 feet or less; or a slope of 100:1 for a distance of 20,000 feet if the runway is longer than 3,200 feet.

The Tracy Airport northwest/southeast and east-west runways are in excess of 35,000 feet from the project site, therefore, neither the transmission line towers nor the stacks will protrude through this aviation "regulatory surface" at these distances from either runway. Therefore, an FAA Notice of Construction is not be required for the TPP transmission interconnection line or plant stacks construction or operation. Because of the distance from the project site, the stacks and transmission lines also will not protrude through the "regulatory surface" of the Meadowlark Landing Strip, and an FAA Notice of Construction is not required with respect to this landing facility.

4.2.2 Audible Noise and Radio and Television Interference

When a transmission line is in operation, an electric field is generated in the air surrounding the conductors forming a “corona”. Corona results from the partial breakdown of the electrical insulating properties of the air surrounding the conductors. When the intensity of the electric field at the conductor surface exceeds the insulating strength of the surrounding air, a corona discharge occurs at the conductor surface. Corona discharge represents a small dissipation of heat and energy. Some of the energy may dissipate in the form of small local pressure changes that result in audible noise or in the form of a discharge that results in radio or television interference. Audible noise generated by corona discharge can be characterized as a hissing or crackling sound that, under certain conditions, is accompanied by a 120 hertz hum.

The conductors of high voltage transmission lines are designed to be free of corona under ideal conditions. However, slight irregularities or water droplets on the conductor surface accentuate the electric field strength near the conductor surface, making corona discharge and the associated audible noise more likely. The Electric Power Research Institute (EPRI, 1978, 1987) has conducted several studies of these effects. Typical noise levels for transmission lines with wet conductors are presented in Table 4.2-1.

Table 4.2-1. Typical Audible Noise from Corona Discharge

Line Voltage	Audible Noise Level
138 kV	33.5 dbA
240 kV	40.4 dbA
356 kV	51.0 dbA

dbA = decibels measured using the A-weighted scale.

During rainfall, the proposed transmission line will produce corona discharge noise levels roughly equivalent to those found inside a residence at night, and the transmission line noise will be largely masked by the noise of the rain. The maximum noise levels are encountered directly under the transmission line, where levels are estimated to be approximately 40 dbA during rainfall. These levels are well below applicable limits specified in the Noise Ordinance for Alameda County. The nearest residence is more than 600 feet from the transmission line tie-in, so impacts from corona noise discharge will not be significant.

Pacific Gas and Electric (PG&E) owns and operates several existing transmission lines that pass the project site to the east and west and converge at the Tesla Substation. The addition of the transmission interconnect line from the site to the Tesla Substation should not cause any radio or television interference.

4.2.3 Electromagnetic Fields

Whenever electricity is used or transmitted, electric and magnetic fields are created by the electric charges. Electric charges of opposite sign attract each other, while those of the same sign repel each other. These forces of attraction and repulsion - when not moving - create electric fields. The strength of these fields is related to the voltage in the circuit. Once electric charges are in motion they create magnetic fields. The strength of the magnetic field is proportional to the magnitude of the current in the circuit. The strength of the electric and magnetic fields generally fall off rapidly with distance from the source.

The voltage, electric and magnetic field strengths induced by high voltage transmission lines are provided in the EPRI Transmission Line Reference Book - 345 kV and Above, Second Edition (EPRI, 1987). The maximum electric field strength for a 230 kV line would be on the order of 1.32 kilovolts per meter (kV/m) to 1.70 kV/m. These values are the maximum, unperturbed fields calculated at 1 meter above the ground directly under the line and at the edge of the rights-of-way. For a typical 95 foot pole with 800 foot span, the maximum calculated magnetic field strength directly under the line and at the edge of the 60-foot right-of-way is 73 mG and 44 mG, respectively. While California does not have a regulatory limit for magnetic field strength, these values are well below the levels established by those states that do have regulatory limits. States with magnetic field regulations have limits ranging from 150 mG to 250 mG at the edge of the rights-of-way, depending on line voltage. Average values reported to the California Energy Commission (CEC), for 230 kV transmission lines licensed by the CEC, have been less than 100 mG (CEC, 1992).

4.2.4 Induced Voltage and Current

Hazardous shocks could be caused by a high voltage transmission line, if it is not properly constructed. The 230 kV generation tie line constructed for this project will be built in conformance with California Public Utilities Commission (CPUC) General Order 95 (GO-95) and California Code of Regulations (CCR), Section 2700 requirements, and therefore hazardous shocks are unlikely to occur as a result of the project operation.

Nuisance shocks can be caused by touching ungrounded metallic objects under or near a transmission line. Assuming a large object remains under the 230 kV generation tie line for a lengthy period of time (i.e. parked farm tractor, or other ungrounded platform) and also assuming the maximum value of electric field, the induced short-circuit currents would be negligible. Any permanent metal object, such as a metallic fence built near the transmission line will be grounded.

The 230 kV transmission interconnect line from the project site to the Tesla Substation will be constructed in accordance with National Electric Safety Code (NESC) requirements, including the provisions for proper grounding of structures. The NESC requirements are intended to minimize the potential for direct or indirect contact with energized lines, therefore, no significant transmission line impacts will occur to the public.

4.2.5 Fire Prevention

Title 14, CCR, Section 1250, Article 4 establishes fire prevention standards for electric utilities. The TPP will comply with these standards.

4.3 RELIABILITY AND AVAILABILITY

This section discusses plant reliability and availability, equipment redundancy, fuel availability, water availability, and project quality control measures.

4.3.1 Plant Reliability and Availability

The planned operational life of the project is 30 years. In order for this life to be realized, and in order for the plant to operate reliably, a preventative maintenance program will be implemented for the project. This program will begin during engineering and procurement for the project, when designs and specifications will be reviewed for reliability and maintainability of plant systems and equipment. During the operational phase of the project, the preventative maintenance program will consist of monitoring, record keeping, and maintenance work to detect and rectify deterioration in systems and equipment before such deterioration results in a forced outage or prolonged maintenance outage.

It is expected that the preventative maintenance program will result in high plant availability. Plant availability refers to the plant's available generating capability during a given period of time, and is assessed using the Equivalent Availability Factor (EAF). The EAF is a weighted average measure of plant availability considering both full and partial outages. In determining the EAF, outages are weighted by magnitude (i.e., fractional reduction in available generating capacity) and duration. Outages consist of planned overhauls, maintenance outages, and forced outages. The plant's annual EAF is expected to be in the range of 92 to 96 percent.

The technology and configuration selected for the project is a well proven design resulting in high reliability from initial commercial operation date. Minor early start-up adjustments are a part of any project, however, but are expected to be smoothed through during the first 24 months of operation. Models predict EFOR (effective forced outage rates) for the project of 3.6% in year one, 2.2% in year two, and down to 1.4% for the period after 24 months, representing the matured reliability.

4.3.2 Equipment Redundancy

Equipment redundancy provides means for avoiding outages and reducing the magnitude of outages. For example, because the plant will include two air compressors of 100% capacity each, an outage of a single air compressor would not result in a plant outage. As another example, because the cooling tower will consist of multiple cells, an outage of one cell would result in a minor partial outage (i.e., minor reduction in available generating capacity) rather than a full outage.

Equipment redundancy also provides for operating flexibility and efficiency. For example, although the turn down capability of individual CTGs is limited to about 50%, the plant will be able to turn down to approximately 25% load by shutting down one redundant CTG/HRSG train. Similarly, because of multiple CTG/HRSG trains, condensate pumps, boiler feed pumps, circulating water pumps, and cooling tower cells, plant efficiency at 50% load will be similar to efficiency at 100% load by selectively shutting down redundant equipment. A summary of major equipment redundancy is presented in Appendix F.

4.3.3 Fuel Availability

The project will be fueled with natural gas via a new 2.8-mile interconnection to the PG&E California Gas Transmission System south of the intersection of I-205 and Patterson Pass Road in San Joaquin County. Based on the project natural gas requirement, a 24-inch diameter transmission main will supply sufficient capacity to the project site. Typical delivery pressure will be greater than 550 psig.

4.3.4 Water Availability

Water for the TPP will be provided by Rosedale-Rio Bravo Water District in cooperation with Zone 7 and the California Department of Water Resources (See Section 5.4 for further discussion).

Annual average water requirements are approximately 5,000 acre-feet per year, as presented in Table 3.4-9. The water will be conveyed via a 1.7 mile long, 20-inch diameter water supply pipeline extending from the California Aqueduct to the plant site.

At the power plant site, a raw water storage tank with a capacity of 8.365 million gallons will hold 8.065 million gallons of water for plant operation. This quantity is sufficient to cover a 24-hour interruption of water supplied to the power plant. In addition, the raw water storage tank will hold 300,000 gallons of water dedicated to the plant's fire protection water system.

4.3.5 Project Quality Control Measures

The project will require quality control measures to be implemented by suppliers and contractors providing equipment and services to the project. This requirement will apply to the engineering, procurement, construction, and startup phases of the project. It is expected that such measures will be part of quality assurance programs established by the suppliers and contractors. The project will audit the quality assurance programs, and will also supplement the programs with independent design reviews, shop inspections, and construction site inspections.

4.4 APPLICABLE LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

Design, construction, and operation of the TPP including transmission lines, pipelines, and ancillary facilities will be conducted in accordance with all LORS pertinent to reliability and availability, and transmission line safety and nuisance. The applicable LORS are discussed in the following sections. Section 5.14, Worker Safety, provides a comprehensive discussion of project safety plans and programs and compliance with all applicable LORS.

4.4.1 Power Plant Reliability

The following LORS are applicable to the proposed TPP in the context of power plant reliability and availability.

4.4.1.1 Industry Codes and Standards

Currently, there are no industry codes or standards that govern power plant reliability; however, there are trade organizations and associations that are generally recognized as authorities and leaders in the field of power plant availability and reliability. Definitions used by these organizations have become generally accepted as a common means of communicating and the data published have been found to be useful. The organizations are:

- The Electric Power Research Institute (EPRI). Copies of reports can be obtained from the Research Reports Center:

  3412 Hillview Avenue
  Palo Alto, California 94304-1395
  (650) 855-2000

- North American Electric Reliability Council (NERC):

  Princeton Forrestal Village
  116-390 Village Blvd.
  Princeton, New Jersey 08540
  (609) 452-8060

4.4.1.2 TPP Compliance with Power Plant Reliability LORS

As described in Section 4.3, above, the TPP will be designed for reliable operations for an expected project life of 30 years. To create and maintain reliable operations, the TPP will include a maintenance program, equipment redundancy, dependable fuel source, and water obtained from the Rosedale-Rio Bravo Water District, delivered by Zone 7 in cooperation with the California Department of Water Resources.

4.4.2 Transmission Line Safety and Nuisance

4.4.2.1 Federal Authorities and Administering Agencies

49 USC § 1348; 14 CFR Part 77. The proposed facility must submit a "Notice of Proposed Construction or Alteration" (NPCA), FAA Form 7460-1H, if it affects the navigable airspace in the region. Criteria have been established to determine if the transmission line needs to be marked. This requirement is not applicable because the transmission line and facility stacks are approximately 7 miles from the nearest landing strip and neither the HRSG stacks nor the transmission poles exceed 200 feet in height.

The administering agency for the above authority is the FAA.

47 USC § 15.25. This authority requires mitigation for any device that causes communications interference.

The administering agency for the above authority is the FAA.

4.4.2.2 State Authorities and Administering Agencies

California Public Resources Code §25000 *et seq.*, Warren-Alquist Act, §25520 Subdivision (g). Requires a detailed description of the transmission line, including all right-of-ways.

The administering agency for the above authority is the CEC.

General Order 52(GO-52) CPUC. Requires the prevention or mitigation of any inductive interference caused by the transmission lines.

The administering agency for the above authority is the California Public Utilities Commission (CPUC).

General Order 95 (GO-95) CPUC. Establishes rules and guidelines for transmission line construction.

The administering agency for the above authority is the CPUC and CEC.

Title 14, CCR, Section 1250, Article 4. Establishes fire prevention standards for electric utilities. The TPP will comply with these standards.

4.4.2.3 Local Authorities and Administering Agencies

Alameda County Energy Element. The Alameda County General Plan, Energy Element, describes general policies regarding energy development in the County.

The administering agency for the above authority is the Alameda County Planning and Community Development Department.

4.4.2.4 Industry Codes and Standards

Radio and Television Interference (RI/TVI) Criteria. Criteria established to determine if any mitigation is necessary.

The administering agency for the above authority is the CEC.

4.4.2.5 TPP Compliance with Transmission Line Safety and Nuisance LORS

TPP's compliance with aviation safety, audible noise, and communication interference and hazards are fully described in Section 4.2.

4.5 REFERENCES

California Building Code (CBC). 1998. Title 24 (Part 2) of the California Code of Regulations.

California Energy Commission (CEC). 1992. High Voltage Transmission Lines, Summary of Health Effects Studies. July 1992.

Electric Power Research Institute (EPRI). 1978. Transmission Line Reference Book, 115-138 kV.

Electric Power Research Institute (EPRI). 1987. Transmission Line Reference Book, 345 kV and above.

Federal Emergency Management Agency (FEMA). 2001. Flood Insurance Rate Map, unincorporated areas of Alameda County. FEMA Q3 Flood Data (http://www.esri.com).